$$s_u[n] = \sum_{l=-\infty}^{\infty} A_u[l] h_u[n - lN] \, . \tag{101}$$

N = M + P is the length of the time domain symbol plus the Guard Interval. $h_u[n]$ is the pulse response of the sound u and may be written as

$$h_u[n] = \begin{cases} e^{j\frac{2\pi}{M}un} & \text{for} \quad n = 0, 1, \ldots, M-1 \\ 0 & \text{else.} \end{cases} \tag{102}$$

In order to guarantee a real value time signal, $A^*_u[n]$ is applied to the sound M-u, M being the block length of the IDFT processing.

$$s_u[n] = \sum_{l=-\infty}^{\infty} \Big( A_u[l] h_u[n - lN] + A^*_u[l] h_{M-u}[n - lN] \Big) \tag{103}$$

$$= \sum_{l=-\infty}^{\infty} \Big( A_u[l] h_u[n - lN] + A^*_u[l] h^*_u[n - lN] \Big) \tag{104}$$

In order to reduce the power density spectrum (PSD) of $s_u[n]$ within the fade-out range, the sounds i, $i \in K_I$ are used to transmit the compensation signals. The set $K_I$ contains the index of those sounds that should be used for compensation.

$$\begin{aligned} s_u[n] = \sum_{l=-\infty}^{\infty} \Big( & A_u[l] h_u[n - lN] \\ & + A_u[l] \Big( [c_u[0]]_1 h_{i_1}[n - lN] + \cdots + [c_u[0]]_I h_{i_I}[n - lN] \Big) \\ & \qquad \vdots \\ & + A_u[l - R + 1] \Big( [c_u[R-1]]_1 h_{i_1}[n - lN] + \cdots + [c_u[R-1]]_I h_{i_I}[n - lN] \Big) \Big) \\ & + CC \end{aligned} \tag{105}$$

The first row corresponds to a conventional DMT signal when $A_u[l]$ is applied to the sound u. I is the number of elements that are contained in the set $K_I$. In the second line, the actual data $A_u[l]$ are not transmitted by the sound u, but weighted versions of $A_u[l]$ are transmitted by the sounds i, $i \in K_I$. The weighting of $A_u[l]$ is effected by the weighting vector $c_u[0]$. $[c_u[0]]_i$ is the i^th^ coordinate of the vector $c_u[0]$. The transmission of the weighted versions of $A_u[l]$ by the sounds i, $i \in K_I$ should minimize the effect of $A_u[l]$ within the fade-out range. The following lines correspond to the transmission of the weighted and delayed $A_u[l-r]$, r = 1,2,...R-1. This should minimize the effect of the past values $A_u[l-r]$ within the fade-out range. The number R determines the memory. The optimal selection of the weighting factors $c_u[r]$, r = 0, 1, ..., R-1 will be explained herein after.

A more compact notation can be achieved by using vectors.

$$s_u[n] = \sum_{l=-\infty}^{\infty} \left( A_u[l] h_u[n - lN] + \sum_{r=0}^{R-1} A_u[l - r] c_u^T[r] h_{\mathcal{I}}[n - lN] \right) + \mathrm{CC} \tag{106}$$

The column vector $h_{\mathcal{I}}[n]$ contains the pulse responses at the instant of time n of the sounds used for compensation and may be written as

$$h_{\mathcal{I}}^T = \left[ h_{i_1}[n] \; h_{i_2}[n] \; \ldots \; h_{i_I}[n] \right] \qquad \text{with} \qquad \{i_1, i_2, \ldots, i_I\} = \mathcal{K}_{\mathcal{I}}. \tag{107}$$

In the case considered up to now, only one sound u is being transmitted. Now we will discuss the case in which not only one sound, but all the sounds u, $u \in K_u$ are transmitted.

$$\begin{aligned} s[n] &= \sum_{k \in \mathcal{K}_{\mathcal{U}}} s_u[n] \\ &= \sum_{k \in \mathcal{K}_{\mathcal{U}}} \left( \sum_{l=-\infty}^{\infty} \left( A_u[l] h_u[n - lN] + \sum_{r=0}^{R-1} A_u[l - r] c_u^T[r] h_{\mathcal{I}}[n - lN] \right) + \mathrm{CC} \right) \end{aligned} \tag{108}$$

$$= \sum_{l=-\infty}^{\infty} \left( A^T[l] h_{\mathcal{U}}[n - lN] + \sum_{r=0}^{R-1} A^T[l - r] C[r] h_{\mathcal{I}}[n - lN] \right) + \mathrm{CC} \tag{109}$$